

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

PIPELINE (feet) CODE 516

DEFINITION

Pipeline having an inside diameter of 8 inches or less.

PURPOSE

To convey water from a source of supply to points of use for livestock, *wildlife*, or recreation.

CONDITIONS WHERE PRACTICE APPLIES

Where it is desirable or necessary to convey water in a closed conduit from one point to another, to conserve the supply, or for reasons of sanitation.

Scope

This standard applies to pipelines that are installed for livestock watering or for recreational areas.

CRITERIA

Capacity

For livestock water, the installation shall have a capacity to provide seasonal high daily water requirements for the number and species of animals to be supplied. *For supplying livestock water, the installation shall have the capacity to provide at least the gallons per head per day in Table 1.*

Table 1

| <i>Animal</i> | <i>Gallons per Animal per Day</i> |
|-------------------------------|-----------------------------------|
| <i>Beef cattle and horses</i> | <i>12</i> |
| <i>Dairy cattle</i> | <i>25</i> |
| <i>Sheep</i> | <i>1-1/2</i> |

For recreation areas, the water capacity shall be adequate for all planned uses. Typical examples are drinking water, fire protection, showers, flush toilets, and irrigation of landscaped areas.

Additional water capacity will be provided for wildlife when applicable.

Sanitary Protection

If water from the pipeline is to be used for human consumption, applicable state and local regulations shall be met and the pipe must be marked or certified for potable water supply by the National Sanitation Foundation (NSF) in accordance with Hawaii State Department of Health requirements.

Pipe

All pipe must withstand the pressure it will be subjected to, including hydraulic transients, internal pressures and external pressures. As a safety factor against surge or water hammer, the working pressure should not exceed 72% of the pressure rating of the pipe and the design flow velocity at system capacity should not exceed 5 ft/sec. If either of these limits is exceeded, special consideration must be

given to flow conditions and measures must be taken to adequately protect the pipeline against surge.

The minimum acceptable class of pipe shall be that having a pressure rating for water of 80 psi.

Steel pipe shall meet the requirements of ASTM Specification A-120. Table 2 contains information extracted from ASTM A120 for Schedule 40 pipe.

*Table 2
Dimensions for Schedule 40
Standard Steel Pipe*

| <i>Nominal Size Diameter (in.)</i> | <i>Outside Diameter (in.)</i> | <i>Wall Thickness (in.)</i> | <i>Inside (in.)</i> |
|--|---------------------------------------|-------------------------------------|-------------------------|
| 1/2 | 0.840 | 0.109 | 0.622 |
| 3/4 | 1.050 | 0.113 | 0.824 |
| 1 | 1.315 | 0.133 | 1.049 |
| 1-1/4 | 1.660 | 0.140 | 1.380 |
| 1-1/2 | 1.900 | 0.145 | 1.610 |
| 2 | 2.375 | 0.154 | 2.067 |
| 2-1/2 | 2.875 | 0.203 | 2.469 |

Plastic pipe shall conform to the requirements of the following ASTM specifications, as applicable:

D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80

D 1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D 2104 Polyethylene (PE) Plastic Pipe, Schedule 40

D 2239 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter

D 2241 Poly(Vinyl Chloride) (PVC), Pressure-Rated Pipe (SDR)

D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)

D 2447 Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter

D 2513 Thermoplastic Gas Pressure Pipe, Tubing and Fittings

D 2737 Polyethylene (PE) Plastic Tubing

D 2672 Joints for IPS PVC Using Solvent Cement

D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches

AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inches

High density polyethylene pipe (HDPE) shall be identified as Type III, Class C, Category 5, Grade P34. Materials for HDPE pipe shall be PE 3407^{1/} or PE 3408^{2/} and have properties that conform to the requirements of the following ASTM specifications, as applicable:

D 1248 Polyethylene Plastics Molding and Extrusion Materials

D 3350 Polyethylene Plastics Pipe and Fitting Materials

^{1/} Commercial name Sclair pipe PE 3407 or equivalent

^{2/} Commercial name Drisco pipe 8600 or Nipak PE 3408 or Polaris PE3408 (200 psi) or equivalent

Plastic pressure pipe fittings shall conform to the following ASTM specifications, as applicable:

D 2464 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D 2466 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D 2467 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40

D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe

D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

Solvents for solvent-welded plastic pipe joints shall conform to the following ASTM specifications, as applicable:

D 2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

D 2564 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D 2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Joining

Drainage

Valves or unions shall be installed at low points in the pipeline so that the line can be drained as needed. Check valves shall be installed as needed to protect groundwater quality or maintain a full pipeline.

Vents

Design shall provide for entry and removal of air along the pipeline, as needed, to prevent air locking or pipe collapse. When pipelines are laid over rolling terrain, high points in the line will tend to collect air. If summits occur in a pipeline, air release valves should be used to release entrapped air. If parts of the line are above the hydraulic gradient, periodic use of an air

pump may be required. Provisions shall be made for pressure relief, air relief and vacuum relief as needed to protect the pipeline.

Joints

Watertight joints that have a strength equal to that of the pipe shall be used. Couplings must be of material compatible with that of the pipe or be completely insulated. If they are made of material susceptible to corrosion, provisions must be made to protect them. Joints shall be capable of withstanding impact and working pressure equal to or greater than that for the pipe.

Design Procedure

General

The design procedure and tables contained in the Hawaii supplement to the Engineering Field Handbook (EFH), Part 650, Chapter 3, can be used to properly size pipeline systems. This procedure is limited to pipelines up to 2-1/2 inches in diameter, 3,000 feet long, 100 feet change in elevation, and 100 psi or less meter pressure. Pipelines above these limits will require a special design.

High Density Polyethylene Pipe

Thermal expansion shall be considered in the design of high density polyethylene pipe systems laid on the ground surface. The pipe shall be restrained in areas where pipe movement is likely to cause damage to the pipe itself, from moving up against existing structure or rock outcrop, attached to surrounding structures, steep slopes, and make access to the right of way difficult. The pipe section before the connection to a trough should be anchored.

Anchors may be earth berms or embankment, buried in place, cast in place or bolted on concrete blocks, and timber supports with cradle.

The pipe shall be anchored or "snaked" at intervals along its length allowing the pipe to

deflect laterally between the anchors. The deflection achieved by "snaking" the pipe shall have the sum of the individual deflections equivalent to the lateral deflection of the pipe. The amount of lateral deflection is to be calculated using the following equation.

$$\Delta W = 0.0067 * L * \sqrt{\Delta T}$$

Where:

ΔW = Lateral deflection of the pipe in feet

L = Length of pipe between anchors in feet

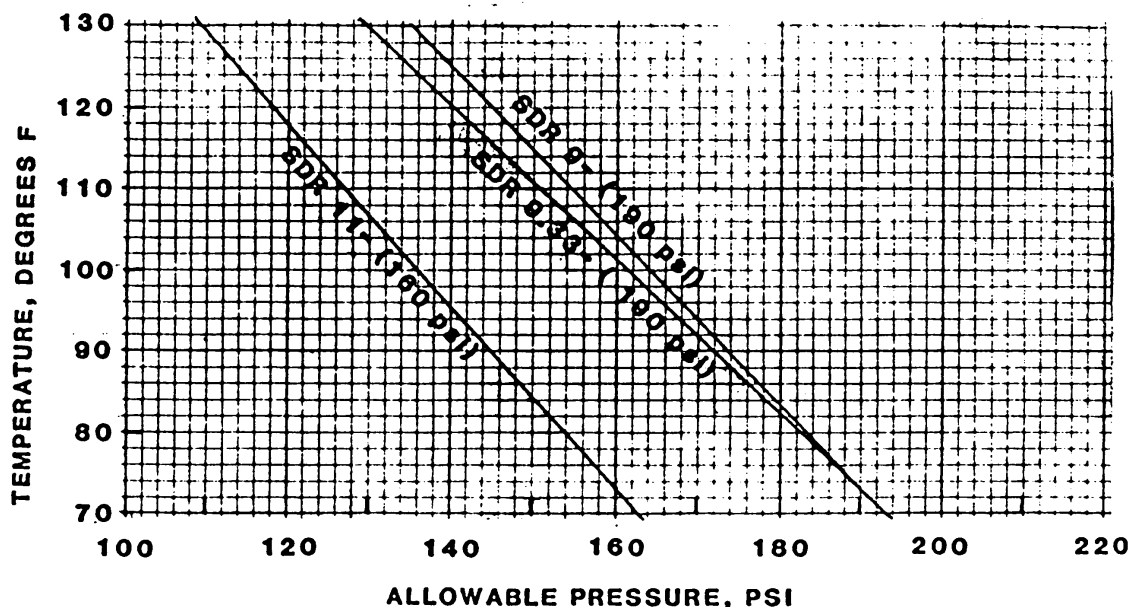
ΔT = Temperature variation in degrees Fahrenheit

The lateral deflection ΔW shall be added to the length of pipe between anchors.

The minimum bending radius of the pipe shall not be exceeded. The minimum bending radius is the pipe diameter in inches multiplied by 50. To avoid exceeding the bending radius standard fabricated polyethylene fittings shall be used. Anchors shall be used on sharp bends to prevent all pipe movement from concentrating in this area.

The temperature of the water being conveyed will have an effect on the service capability of the pipe. The allowable pressure rating of the pipe shall be decreased for fluid or environmental temperatures above 73°F, as shown in Figure 1. Pipes shall not be installed in areas where the temperature will exceed 130°F.

FIGURE 1
ALLOWABLE PRESSURE VS. TEMPERATURE



SDR 9 - Nipak PE 3408 and Sclair pipe PE 3407 (Also Polaris PE 3408, 200 psi)

SDR 9.33 - Drisco 8600

Protection

Steel pipe shall be galvanized.

Plastic pipe installed above ground shall be resistant to ultraviolet light throughout the intended life of the pipe.

All pipes shall be protected from hazards presented by traffic, farm operations, freezing temperatures, fire, thermal expansion and contraction. Reasonable measures should be taken to protect the pipe from potential vandalism.

Vegetation

Disturbed areas shall be established with vegetation or otherwise stabilized as soon as practical after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to NRCS Conservation Practice Standard 342, Critical Area Planting.

Visual resources

The visual design of pipelines and appurtenances in areas of high public visibility shall be carefully considered.

CONSIDERATIONS

No special considerations have been identified for this practice.

PLANS AND SPECIFICATIONS

Plans and specifications for installing pipelines shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. If the pipeline is a component of a system that includes additional conservation practices, the information necessary to construct these additional practices will also be conveyed on the plans.

EFH, Part 650, Chapter 5, will guide the development of plans.

The following should be included in the plan:

- 1. Location map or sketch.*
- 2. Number of animals to be served.*
- 3. Length of pipeline.*
- 4. Pressure rating of pipe.*
- 5. Pipe material and type.*
- 6. For plastic pipe, the burial depth.*
- 7. Location of valves.*
- 8. Location of outlets.*

OPERATION AND MAINTENANCE

An O&M plan specific to the type of installed pipeline shall be provided to the landowner. The plan shall include, but not be limited to, the following provisions:

- Opening/closing valves to prevent excessive water hammer;*
- Filling at the specified rate requirements;*
- Inspecting and testing valves, pressure regulators, pumps, switches and other appurtenances;*
- Maintaining erosion protection at outlets;*
- Checking for debris, minerals, algae and other materials which may restrict system flow; and*
- Draining and/or providing for cold weather operation of the system.*

REFERENCES

NRCS Engineering Field Handbook.